Mechanical & Industrial Engineering
Course and Option Talk - **Mechatronics**
3rd Year Curriculum Overview

FALL

- MIE301: Kinematics and Dynamics of Machines (my course)
- MIE312: Fluid Mechanics I
- MIE342: Circuits with Applications to Mechanical Engineering Systems
- MIE258: Engineering Economics and Accounting
- Natural science requirement

WINTER

- MIE315: Design for the Environment
- MIE313: Heat and Mass Transfer
- MIE334: Numerical Methods I
- Two stream option courses
4th Year Curriculum Overview

FALL

- MIE491: Capstone Design
- Two stream option courses
- One Technical Elective
- Other: HSS or CS Elective

WINTER

- MIE491: Capstone Design
- Three Technical Elective courses
- Other: HSS or CS Elective
3F Term – MIE342 – Circuits with Applications to Mechanical Engineering Systems

Course Description: Teaches basic techniques for analyzing circuits (things like current and voltage laws) and circuit components (such as sources, inductors, capacitors, op-amps etc.)
3W Term – MIE346 – Analog & Digital Electronics

Course Description: Teaches advanced circuits – motor drivers, oscillators, filters, plus new semiconductor devices (diodes, MOSFETs, BJTs), plus real world design and analysis.
Teaches **general methods to control a feedback system;** both mathematical and practical (i.e.: Magnetic Levitation control lab)
Notable Technical Electives

MIE443
Mechatronic Systems Design and Integration

Design Course – Teaches the design process, automation, and integration of real-world Mechatronics systems (practical design)

MIE444
Mechatronics Principles

Design Course – Smart Systems, Interfacing and Control, Modeling, and a practical project (build a line follower)
Technical Elective: MIE438 – Microprocessors and Embedded Microcontrollers

- **Embedded Systems** – Everything from home and office appliances to video game consoles, cars to cell phones, etc.
What is MIE438 about?

- Number representations (175 = 10101111 = 0xAF)
- Machine-level programming
- Translation between high level code (C, Python, etc.) and low level (Assembly) codes
- Interfacing with inputs and outputs (sensors, motors, LCD, etc.)
- CPU-based control
- ...

Course Project: Design and build a Mechatronics-related embedded system using a microcontroller

Past Project Examples:
- Automatic Card Dealer
- Gesture-Controlled Helicopter
- Cell-phone Controlled Robot
- Rubik’s Cube Solver
- Pendulum Damping Cart
- Shooting Gallery Game
Mechatronics Overview

• Interdisciplinary:
  – Mechanical, electrical, computer science

• Design of **complete** modern mechanical systems with integrated electronic components

• Examples: robots, appliances, cars, aircraft, spacecraft...
Mechatronics - Jobs

• Mechatronics is often misunderstood as a field:
  – “Control Engineer”, “Electrical Engineer”, “Automation Engineer”, “Industrial Engineer”, etc.

• Most commonly listed by secondary specialization, when the real goal is still to hire someone with mechatronics background

• Suggestion: Explore a secondary specialization, especially after graduating, and highlight this to potential employers. Build a design portfolio.
Mechatronics Research: MEMS
(Micro-Electro-Mechanical Systems)

Relevant Labs: Profs. Liu, Sun, Mills, Ben Mrad
Mechatronics Research: Computer Vision

Example: active vision: Using cameras that move in response to what they are seeing, in order to see better in the future. May also be predictive, moving in anticipation of future actions.

Relevant Labs: Profs. Benhabib, Nejat
Mechatronics Research: Robotics

Swarm Robotics and mROBerTO

Human-Robot Interaction (Goldie Nejat)

Relevant Labs: Profs. Diller, Sun, Nejat, Mills, Benhabib
Wireless Medical Microgripper

- 3D symmetric structure
- controlled by a single magnetic field
- reliably grip cargoes of various shapes
- fast grip-and-release up to 20 Hz in water
- no adverse effect on living cells
- --> applying to biopsy tasks

Real-time autonomous microgripping and cargo delivery

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Questions?

Image from i-mechatronics.blogspot.ca